WEAPONS OF THE TRENCH WAR 1914–1918

ANTHONY SAUNDERS

Before 1914, trench warfare was a type of fighting unforeseen by the armies of Britain, France and Germany, so none was equipped to fight it. Specialised weapons and equipment were needed for the violent environment of the trenches and these had to be developed and introduced to the Front as quickly as possible. In Britain, a plethora of 'inventions' departments sprang up to address the problem and from these there emerged a number of remarkable weapons, although some came from civilians such as William Mills and Wilfrid Stokes. Hand and rifle grenades as well as trench mortars emerged as potent weapons that had a fundamental impact on the conduct of the fighting in the trenches.

The author's detailed and authoritative text looks at innovation in the trenches, principally from the British viewpoint, but he also describes equipment used by other combatants. He includes weapons and associated equipment designed to overcome the problems of trench warfare at trench level, and examines some of the unsuccessful ideas that never made it to the Front. Some of the weapons, like the Livens Projector, have remained largely unknown. The author's narrative describes each type of equipment, its development and effectiveness, and what the troops at the Front thought of it, as well as official reaction to the weapons.

The source material, much of which is previously unpublished, has been drawn from files in the Public Record Office and from UK patents – a rich but little-used source of detailed information about First World War weapons inventions. The comprehensive range of illustrations that support the text include contemporary photographs and detailed drawings.

This is the first book to cover First World War trench weaponry in detail and as such will appeal to everyone with an interest in this landmark conflict of the twentieth century. It sheds new light on the war and shows that the development of these weapons had an impact on the conduct of the fighting.

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ANTHONY SAUNDERS

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Contents

	Acknowledgements	vi
	Introduction	vii
Chapter 1.	JAM-TINS, PITCHERS AND BALLS – HAND GRENADES 1914–15	1
Chapter 2.	DRAINPIPES, TOFFEE-APPLES AND FLYING PIGS – TRENCH MORTARS 1914–15	28
Chapter 3.	RUBBER BANDS AND SPRINGS – CATAPULTS 1914–15	51
Chapter 4.	MILLS AND PATENT HAND GRENADES 1915–16	67
Chapter 5.	TIMED EGGS AND THE ELUSIVE PERCUSSION GRENADE 1916–18	87
Chapter 6.	RODS AND PHOSPHORUS – RIFLE GRENADES AND CHEMICAL GRENADES 1914–18	95
Chapter 7.	NEW WAYS TO THROW NEW BOMBS – GRENADE LAUNCHERS 1916–18	108
Chapter 8.	A TALE OF TWO STOKES – MORTARS 1915–18	124
Chapter 9.	OIL CANS AND PROJECTORS – LIVENS, FLAME AND GAS 1915–18	142
Chapter 10.	WINNERS AND LOSERS	157
Appendix	PATENTS TABLES	161
	Sources	169
	Index	171

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Introduction

Much has been written about the First World War. As far as I am aware, this is the first book devoted solely to the weapons designed specifically for use in the trenches. Such weapons played an important part in the trench war from late 1914 onwards. Without them, the outcome of the First World War might have been very different. Some, like the Mills hand grenade and the Stokes mortar, made major contributions to Britain's victory in 1918 as they significantly increased the offensive capabilities of the British Army. However, when the British Expeditionary Force (BEF) went to France in August 1914, it possessed no rifle grenades, no trench mortars, indeed no equipment of any kind designed for trench warfare. All it had was a meagre supply of unsuitable hand grenades.

This was not due to incompetence. Rather, it was because the likelihood of such equipment ever being needed had seemed extremely remote since a prolonged period of entrenchment was not predicted. Although trenches had been a feature of warfare for a very long time, trench warfare was virtually unheard of before October 1914. Digging in by soldiers to protect themselves from small arms fire had been common practice for about forty years but fighting that could be described as trench warfare had never followed. However, ten years before the outbreak of the First World War, embryonic trench warfare had occurred during the Russo-Japanese War in Manchuria but it was of short duration and had arisen under siege conditions. Neither side had weapons suitable for this kind of warfare so they had to be improvised; the grenade and the trench mortar emerged as potent killers. The British Army did not foresee itself getting involved in sieges in any future European war.

The European powers had all sent observers to Manchuria. Although there were lessons to be learned from the Russo-Japanese War, no one saw it as a warning of what might happen in a future European war. What was not fully appreciated at the time was why trench warfare had arisen in the first place. There had been a revolution in small arms and artillery in the last decades of the nineteenth century during which firepower and accuracy had increased enormously. Tactical developments, on the other hand, had not kept pace with this revolution. The result was the slaughter of exposed infantry. When the BEF went to France in August 1914, it expected the fighting to follow the principles set out in its training manuals, which described tactics that were better suited to the middle of the nineteenth century than to the second decade of the twentieth. Infantry would engage each other at 1,200–1,500 yd, closing to 800–1,000 yd for the main battle. It was anticipated that the decisive range would be 400–500 yd, the battle going to whichever side could 'develop the most accurate and rapid rifle fire'. Concentrated small arms fire was seen to be the most important factor in deciding the outcome of a battle, while artillery was viewed as an ancillary instrument to aid this process.

What this failed to take into account was the intensity of the small arms fire that could be brought to bear with modern, magazine-fed, high-velocity rifles which made an exchange of fire at 400–500 yd deadly to both sides. Neither did it consider the devastating effect of modern, quick-firing artillery shooting high-explosive shells against unprotected infantry in the open. Although the fighting of the first few months of the war more or less followed the expected pattern, these two factors, combined with essentially outmoded infantry (and

artillery) tactics, made it impossible for either side to bring about a decisive battle that would defeat the enemy. (One of the most remarkable achievements of the war was the revolution in tactics that allowed an Allied victory in 1918.) The British, French, Belgian and German Armies suffered appalling casualties and became exhausted by seemingly endless fighting, marching, fighting and countermarching in a vain effort to outmanoeuvre the enemy. During October they came to a standstill. Where they stopped, they dug in.

By late 1914 a line of trenches curved across France from the Swiss frontier and into Belgium, terminating on the North Sea coast. The result was stalemate and mutual siege, a situation that remained largely unchanged for about three and a half years despite battles of ever-increasing intensity being fought to try to break the deadlock. With the entrenchment of the armies, the nature of warfare changed almost overnight. Suddenly, not only had the tactics set out in the training manuals become redundant but it became apparent to private soldier and general alike that different types of weapons and equipment were needed. What had happened in Manchuria ten years earlier was now happening in France and Belgium on a massive scale.

The First World War was the first war – indeed the only one – in which massive opposing armies were entrenched opposite each other, separated by a strip of No Man's Land, for an extended period. It caused a radical change in the way the war was fought. During that time, the weapons of siege warfare assumed an importance not seen since the days of Marlborough when sieges were more common than battles. It was no accident that some of the weapons that emerged during late 1914 and throughout much of 1915 were ancient siege weapons such as catapults. Hand grenades, which had last seen widespread use in the eighteenth century, suddenly became essential; by the end of the war, the hand and rifle grenade had practically supplanted musketry as the principal means by which the infantry attacked the enemy. Captain Dunn, the medical officer of the 2nd Battalion, Royal Welch Fusiliers, referred to the 'cult of the bomb' in 1916 and Frank Richards wrote of 1917 that 'The young soldiers that were now arriving had been taught more about the bomb than about the rifle, which some of them hardly knew the way to load'. And the trench mortar became not only indispensable but decisive.

Weapons suitable for trench warfare had to be designed, tested, developed, trialled at the front, modified, sometimes redesigned, and retested and retrialled before finally being manufactured and supplied in large quantities to the front-line troops. For the British, this was neither a smooth nor easy process for much of 1915 and 1916 because of their lack of experience with such weapons and because of conflicting opinions at the Front about what form they should take. Trial and error was sometimes a painful process and for much of 1915 improvisation was the rule rather than the exception. Moreover, there was always a problem finding engineering companies that could take on the manufacture of things such as hand grenades, detonators and mortar ammunition at short notice and make them to the correct specifications. To a large extent, matters were eased by the Second Army Workshop set up by Captain Newton in 1915; many of the grenades and mortars supplied to the Front during 1915 came from this source.

During the course of the war, a profusion of departments came into being to examine the ideas and inventions submitted by members of the public and soldiers serving at the Front. Their brief also included designing new weapons. These departments included the Trench Warfare Department, the Trench Warfare Supply Department, the Design Department and the Munitions Inventions Department (MID), as well as various committees like the Trench Warfare Committee and the committees of the Munitions Inventions Panel, not to mention the Royal Arsenal at Woolwich and the Ordnance Board. The responsibilities of these

departments and committees changed at various times as new departments were created, sometimes by division and amalgamation of existing departments and committees. Duplication of effort was rather more common than it might have been had there been better coordination between them. As late as May 1917 this duplication led General Headquarters (GHQ) France to issue 'Notes on Inventions and New Stores' that described equipment currently under test by GHQ to help prevent such duplication. On the inside front cover it stated:

> It has been found that much waste of time and labour results through experimental work being carried out on patterns of stores which have already been approved for manufacture. In order to obviate this the following notes on some of the more important inventions and new patterns dealt with at General Headquarters . . . are issued for information.

This book is about the weapons that became indispensable to trench warfare – grenades, trench mortars and bomb-throwers. More effort was put into developing these than any other trench warfare store. It focuses on British weapons and equipment simply because lack of space prevents more than a cursory glance at similar equipment adopted by the French and German Armies; this is a vast subject that has been largely unexplored by previous writers about the First World War. Not everything described in what follows was necessarily adopted by the British Army. Much of the effort that went into devising and evaluating new equipment eventually came to nothing, sometimes because the ideas were unsound and sometimes because good ideas could not be made to work effectively and safely; this was uncharted territory and inevitably mistakes were made. It was a constant process of learning and improvement. Sometimes promising weapons were ultimately rejected because they were too difficult to manufacture in quantity despite having undergone successful trials at the Front. Anything that required precision engineering and very tight tolerances was liable to be rejected. And there were a lot of hare-brained ideas that ranged from the Heath Robinson to the outright bizarre.

A huge number of ideas and suggestions came before the trench warfare departments. The MID is a case in point. During February 1918, 982 inventions were submitted to it, of which 880 were considered or sent to a more appropriate department if the submission did not come within its scope (including things related to naval and aerial warfare). In addition, 1,059 inventions were evaluated by the various committees of the Munitions Inventions Panel, 124 of which were considered to be worth further investigation. The MID's monthly report for May 1918 stated that since August 1915, 43,987 inventions and ideas had been submitted to it. Of these, 42,811 were considered by the department or sent to other departments; the panel committees evaluated 39,717 of them and produced reports on 3,549 that appeared to justify further development. By the end of the war, a total of 47,949 submissions had been made to the MID. Not all of these inventions and ideas were related to trench warfare, of course, but the figures give an idea of the enormity of the task of separating the wheat from the chaff. In the end, only 226 proved to be of any use. On the whole, the MID seems to have done a good job although rejection was not always accepted gracefully as all inventors tended to believe that their own project had war-winning potential.

In preparing this book, I have used two principal sources of information: War Office, Ministry of Munitions and Treasury files held at the Public Record Office at Kew, and UK patents that were applied for between August 1914 and November 1918 and subsequently

granted, which are kept at the Science Library at Chancery Lane. The UK patents fall into the following classes: 9 (i) ammunition; 92 (i) ordnance and machine-gun carriages and mountings; 92 (ii) ordnance and machine-guns; and 119 small arms.

There are several hundred relevant patents dating from this period although relatively few of them formed the basis of a weapon that was even trialled at the front let alone officially adopted by the Army. Yet, it is highly probable that most of them were submitted to the MID or some other department for consideration at some stage – otherwise there would have been little point in the invention or in applying for the patent, although some of them related to improvements to existing weapons. However, few submitted inventions were identified as being the subject of patents. Some patents relate to important inventions such as the Mills hand grenade and the Stokes mortar.

Because of the large number of patents, it was not possible to look at all the complete specifications so the patent abridgements had to suffice in many cases and even then it was not possible to examine them all. Unlike the patents, which are arranged numerically irrespective of subject, the abridgements are volumes of extremely shortened versions of the specifications, being grouped numerically by class. They are intended as search tools and provide just enough information to show the nature of an invention to 'a person skilled in the art', i.e. someone who was familiar with the state of the art in a particular field at that time. Until 1916, patents were numbered from 1 at the beginning of each year. To correctly identify these, the year must be added to the number, e.g. 1,234/15. From 1916 the numbers became continuous.

The First World War was a time of great innovation. A tremendous amount of time and effort went into the search for new weapons for the trench war. This book is about the fruits of those labours.

APPENDIX

Patents Tables

Hand Grenades

Application Date	Patent Number	Inventors	Description
10/2/15	2,111	W. Mills	Mills grenade
10/2/15	2,139	W.M. Still & Sons, E.H. Still	Firing pin in handle operated by throwing
10/2/15	7,636	W. Mills	Lever locking mechanism; fitted with rod as rifle grenade
16/2/15	2,468 cognate 3,559/15	W. Mills	Development of Mills bomb
25/2/15	3,091	F.M. Hale	Firing pin in handle; development of Hale grenade described in 4,925/11
6/3/15	3,619	F.E. Baker	Fuse
10/3/15	11,747	C. Besozzi	Grenade
20/3/15	4,392	A.C. Roodhouse	Double spherical walls
20/3/15	4,407	J.F. Buckingham	Fuse
13/4/15	5,553	J.F. Buckingham	Fuse
13/4/15	5,564	J.F. Buckingham	Percussion fuse for spherical grenade
20/4/15	5,900	C.T.B. Sangster	Fuse
20/4/15	5,901	C.T.B. Sangster	Fuse
15/5/15	7,301	W. Mills	Clockwork delay fuse
9/7/15	10,047	L. Bekker, L. Lilienstern	Fuse. No patent granted; sealing fee not paid
20/7/15	10,515 cognate 11,103/15 & 12,867/15	W. Mills	Grenade
28/7/15	10,925	W. Mills, W. Morgan	Fuse
3/8/15	11,223 cognate 12,629/15	W. Mills	Addition to 2,468/15
3/8/15	100,325	W. Mills	Fuse
4/8/15	11,239	J. Gray	Grenade
9/8/15	11,494	P. Hanzer, C. Hanzer	Percussion fuse
10/8/15	11,551	L.L. Billant	Percussion fuse
12/8/15	11,679	J.A. Leeming, F.H. Brewerton F.A. Fraser	Grenade
8/9/15	12,889	J.A. Armstrong	Wheel-shaped grenade which can be rolled along ground or thrown
15/9/15	13,197	G.A. Smith	Fuse igniter of sulphuric acid with sugar and potassium chlorate
18/10/15	14,665	W. Mills, W. Morgan	Fuse
19/10/15	14,793	W. Breeze, Reason Manufacturing Co.	Time fuse
21/10/15	14,904	A.M. Flack	Double-walled grenade
12/11/15	15,984 cognate 16,218/15	H.D. Black, F.H. Brewerton, F.A. Fraser	Grenade
15/11/15	16,083	S.R. Parkes	Grenade
19/11/15	16,327	T.W. Adshead	Grenade
27/11/15	16,749	J. Walster, S. Walster	Fuse
1/12/15	102,479	K.W. Nielsen	Grenade with handle and shrapnel balls
6/12/15	171,144	J.J. Pouly, J.J.M. Daujard	Glass grenade with metal fittings
6/12/15	17,146	W.J. Mellersh-Jackson (Bombrini Parodi-Delfino)	Fuse

Application Date	Patent Number	Inventors	Description
11/12/15	17,397	C.W. Findlay	Manufacture of Mills centre-piece
14/12/15	17,494 cognate 17/16 & 77/16	J.R. Hamilton (J.D. Hamilton)	Double-walled spherical grenade with impact fuse
21/12/15	17,852	S.R. Parkes	Fuse
22/12/15	17,898	S.R. Parkes	Centre-piece
3/1/16	102,812	B.D. Barfleet, A.J.W. Millership	Grenade
10/1/16	102,830	E.B. Temple (formerly E. Bregeon)	Percussion fuse
13/1/16	102,390	R.W.B. Billinghurst	Grenade with all-direction percussion fuse
13/1/16	103,821	J.B. Semple	Tail unwinds in flight and arms grenade
15/1/16	102,279	H.A. Reincke, W.C. Macartney	Grenade with all-ways percussion fuse
18/1/16	103,009	S.R. Parkes	Safety device
21/1/16	102,173	J. Walker	Centre-piece
21/1/16	103,182	Sabulite Ltd, W.H. McCandlish	Percussion fuse for grenade armed in flight by wind-vane
28/1/16	103,353	S.R. Parkes	Time fuse
29/1/16	102,639	A.E. Teery	Fuse for grenade described in 7,636/15 (Mills)
3/2/16	105,932	H.K. Harris	Grenade
17/2/16	124,505	W. Mills	Fuse for Mills
22/2/16	100,718	J.E. Hearn	Grenade in shape of flask
23/2/16	104,204	O. Horton, A. Macpherson	All-ways percussion fuse for spherical grenade
7/3/16	104,539	J.A. Prestwich	Grenade
9/3/16	104,541	H.E. Asbury	Striker mechanism
9/3/16	104,542	H.E. Asbury	Related to 104,541
9/3/16	104,543	S.R. Parkes	Grenade
9/3/16	104,669	H.E. Asbury	Fuse
10/3/16	124,527	S.R. Parkes	Fuse
13/3/16	103,211	H.M. Knight	Practice grenade
4/4/16	13,405	E.W. Coleman	All-ways percussion fuse
12/4/16	105,400	G. Senior	Knife edges to alter flight when 'thrown in a particular manner'
19/4/16	105,417	G.T. Speir	Grenade
3/5/16	124,837	L.A. Daniels, C.A.P. Gardiner	DG grenade
6/5/16	101,196	H.C. Williamson	Grenade
15/5/16	125,100	F.W. Charmier, W. Curtis	Fuse
17/5/16	103,589	K.W. Nielsen	Addition to 102,479; percussion fuse for grenade with conical, flexible tail
5/6/16	102,332	H. Siegwart	Safety device
7/6/16	109,373	F.M. Hale	Mills rifle grenade
14/6/16	106,872	H. Austin	Percussion fuse
15/6/16	141,741	A. Dewandre, J. de Laminne	Fuse
15/6/16	141,742	A. Dewandre, J. de Laminne	Resilient lever to hold safety pin in place; relates to 141,741
15/6/16	141,743	A. Dewandre, J. de Laminne	Percussion cap holder; relates to 141,741 and 141,742
15/6/16	141,744	A. Dewandre, J. de Laminne	Igniting weak percussion cap; relates to 141,743
22/6/16	107,601	E.M. Shinkle	All-ways impact fuse
3/7/16	107,086	S.R. Parkes	Perforated line inside grenade to improve fragmentation
8/7/16	106,555	Oritur Manufacturing Co. J.W.G. Starkey	Manufacture of centre-piece
10/7/16	125,420	F.J.C. Carruthers	Percussion fuse
22/7/16	125,436	F.W. Charmier	Fuse for grenade and trench mortar bomb
4/8/16	124,493	W.J. Davey, E.W. Blake	Fuse
25/8/16	127,293	F.L. Leblanc	Fuse ignition

Application Date	Patent Number	Inventors	Description
1/9/16	125,599	S.R. Parkes	Percussion fuse
12/9/16	102,364	G.C. Salsbury	Centre-piece
14/9/16	103,094	J. Dubois	Grenade
11/10/16	127,279	L.L. Billant	Actuating mechanism
19/10/16	109,858	H.S. Valentine	Frictional fuse
20/10/16	102,917	J.E. Hearn, T.D. Galer	Plugs for grenades
6/11/16	110,915	R.S. O'Neil	Fuse
16/11/16	111,161	E.B. Temple	Percussion fuse
21/12/16	110,068	F.J.J. Gibbons	Fuse for Mills
5/2/17	111,949	F.J.J. Gibbons	Safety pin for Mills lever
14/3/17	126,740	Vickers Ltd, F.G.L. Johnson	Smoke composition for grenades
11/5/17	127,650	E. Sernagiotto, G. Orsi	Liquid filling producing asphyxiating vapour
22/5/17	115,897	P.E. Cheeseman	Fuse
27/7/17	121,272	F.N. Brondby	Percussion fuse
1/10/17	117,734	Dover Ltd, H.W. Dover	Lever for hand grenade
4/10/17	119,678	G.A. Shaw	Grenade
20/11/17	114,122	A.B. Gibbons	Manufacture of centre-piece of Mills
17/6/18	136,857	E.C.R. Marks	Disc-shaped grenade with disc-shaped bullets
11/10/18	123,028	F.J.J. Gibbons	Dummy hand grenade

Rifle-Grenades & Launchers

Application Date	Patent Number	Inventors	Description
2/7/15	16,869	Société de Construction Batignolles (précédement Ernest Gouin et Cie)	Rifle grenade
13/7/15	10,165 cognate 11,113/15	M.E. Brett (C.W. Cole)	Muzzle attachment
13/7/15	10,195 cognate 11,113/15	M.E. Brett (C.W. Cole)	Muzzle extension; uses blank cartridge
30/7/15	100,432	C.S. Walker	Cartridges for rifle grenades fed with rods; cartridge fitted to rod; gas checks
31/7/15	101,095	S. Rogozea	Muzzle extension; grenade has tubular tail which fits over extension; claw and notch arrangement to reduce recoil
22/9/15	13,510 cognate 13,511/15	S.C. Davidson	Constant angle and charge, range determined by venting system
20/11/15	102,371	J. Vivien, G. Bessière	Muzzle extension for grenade which may have short rod; includes grenade
27/11/15	103,109	A. Gauchet	Rifle grenade
8/12/15	17,245	N.L. Fynmore	Auxiliary time fuse to extend range
14/1/16	100,700	J. Vivien, G. Bessière	Muzzle attachment; bullet through centre of grenade
21/1/16	124,478	L.G.P. Thring	Muzzle-loaded launcher with shoulder stock and recoil reducing system
24/1/16	103,012	K. Gauldie, W. Gauldie	Rifle grenade with percussion fuse
18/2/16	124,507	J. Neale	Automatic igniter for time fuse in rifle grenade
21/2/16	101,108	A.L. Chevallier, H.J. Blanch	Muzzle attachment with sliding sleeve, spring, piston and wooden sabot
13/3/16	124,765	F.V. Lister	Cut-down shotgun barrel with socket for grenade
18/4/16	105,945	C.T.B. Sangster	Rifle grenade
1/5/16	101,193	L.W. Williams	Rifle grenade in two parts with rod attachment
2/5/16	105,427	S.R. Parkes	Rifle grenade with time fuse
3/6/16	125,129	C.T.B. Sangster	Rifle grenade
15/6/16	107,195	A. Dewandre, J. de Laminne	Blunderbuss for firing grenade with peripheral ribs

Application Date	Patent Number	Inventors	Description
25/7/16	109,066	W. Mills	Impact fuse for rodded rifle grenade
26/9/16	104,836	J. Vivien, G. Bęssière	Addition to 100,700
26/9/16	109,498	J. Vivien, G. Bessière	Branched muzzle attachment
7/10/16	109,509	Guns & Munitions Ltd, V.C. Doubleday	Mechanism for releasing grenade's lever
20/10/16	107,893	C.T.B. Sangster	Rifle grenade with wind-vane arming device
20/10/16	124,775	C.T.B. Sangster	Rifle grenade with wind-vane arming device
24/10/16	112,954	T.D. Macfarlane, A.J. Penney	Rifle grenade
20/12/16	109,363	M. Barnett	Rod for rifle grenade
5/1/17	126,353	A.L. Chevallier	Spring-mounted muzzle attachment; grenade has hollow tailpiece
24/1/17	130,404	E.A.F. Naud	Fuse
2/2/17	113,126	M. Barnett	Ribbed reinforcing sleeve for barrel
7/2/17	130,406	E.A.F. Naud	Grenade with light cylindrical body and ogival ends to increase range
14/2/17	126,692	R. Burn	Cup discharger
7/3/17	126,733	M. Giorgi	Drawn steel tube attached to muzzle for firing grenade with bullet
29/3/17	128,315	R. Frugier	Funnel-shaped muzzle extension; grenade has hollow cylindrical tail which fits over funnel and is left behind when grenade launched. No patent granted; sealing fee not paid
23/4/17	109,944	K. Hagen	Grenade tube attached to barrel via muzzle extension with hole for bullet gases to propel grenade. Range and recoil modified by different-sized holes
23/6/17	117,064	E. Piersantelli	Crescent-shaped butt of launcher rests on ground or against shoulder; tail of bomb fits in barrel and holds rifle cartridge
18/9/17	119,218	N.W. Aasen	Launching tube mounted parallel to rifle barrel with connecting hole between, with valve in base of tube to regulate gas flow. Void
25/9/17	118,179	D. Kouskoff	Rodded projectile with knife blades on front end for cutting wire
10/10/17	119,852	E. Piersantelli	Addition to 117,064
5/11/17	129,368	S.C. Davidson	Addition to 13,510/15
15/12/17	129,740	G.R. Thatcher	Cup discharger with vent holes
21/2/18	123,182	L.H. Carroll	Grenade with central air passage and cloth tail
22/5/18	127,231	F.N. Brondby	Device for varying range of rifle grenades with tail sleeve and wings; sleeve fits over barrel or extension, the extent of fit determining range
29/5/18	148,766	E. Piersantelli	Three-piece tube with shock-absorbing springs
12/6/18	125,817	J.M. Kaylar	Fires winged projectiles
10/8/18	131,288	E. Brandt	Projectile with fins

Rests for Firing Rifle Grenades

Application Date	Patent Number	Inventors	Description
24/1/16	102,755	K. Gauldie, W. Gauldie	A curved butt attachment
23/3/16	101,441	W.S. Kneeshaw	Rifle stand

Grenade-Throwing Devices

Application Date	Patent Number	Inventors	Description
25/11/14	23,044	M.J. Dawson	Spring-operated arm
2/3/15	100,132	F.F. Fornay	Rifled, breech-loaded spring-operated gun; includes projectile
13/3/15	100,177	Soc. Anon de Commentry-Fourchambault et Decazeville	Mechanical. Void
22/5/15	7,710	C.P. Leach, A.W. Gamage Ltd	Catapult
25/6/15	100,791	F. Schimmel	Mechanical, rotary action; includes pebble projectiles. Void
5/7/15	9,794	V.C. Doubleday	Device for igniting time fuse
22/7/15	10,662	R.T. Glascodine	Catapult using rubber strips
25/8/15	12,298	J. Robertson	Mechanical thrower
6/10/15	14,168	S.C. Davidson	Spring-operated
13/10/15	14,505	C.K. Pellett	Device for launching propeller-driven projectile
9/12/15	17,291 cognate 6,725/16	A. Wood, G. Wood	Pneumatic with chain linkage
10/12/15	124,523	L.M. Pourcel	Pneumatic
31/12/15	18,180	A. Carreras	Torsional spring
2/2/16	103,841	F.F. Mote	Bomb propelled by explosive gases
29/2/16	104,376	W. Storch, C.W. Davis	Bat-shaped thrower
4/3/16	104,672	M. Velin, F. Schimmel	Tube discharging time-fused bombs ignited electrically on discharge
10/3/16	103,379	P.D. Malloch	Hand-thrower
16/3/16	104,893	C.T. Crowden	Pneumatic
20/3/16	120,738	A.P. Lawrence	Mechanical
25/4/16	105,787	J. Gardner	Mechanical
12/5/16	106,141	J.S. Owens, J.M. de M. Vermehr	Magazine-fed
27/5/16	106,656	J.A. Hill	Spring-operated
9/6/16	107,045	J.A. Hill	Development of 106,656
31/8/16	125,597	C. Gori, G. Minucciani	Centrifugal-action; includes fuse for lenticular bomb
14/11/16	137,873	R. Burn	Pneumatic
23/3/17	128,595	G. Constantinesco, J.R. Middleton	Hydraulic piston operated by explosive discharge
26/3/17	116,305	G.P. van Wye	Mechanical
1/6/17	133,070	C. Gori, G. Minucciani	Addition to 125,597
2/6/17	116,330	R.E. Blacker	Spring-operated
8/8/17	126,536	E.S. Jones, S.A. Leblanc	Spring-operated

Trench Mortars

Application Date	Patent Number	Inventors	Description
13/1/15	100,016	F.H.P. Wallis	Mortar and mounting. Void
24/2/15	3,025	A. de M. Bellairs	Fired by explosive mixture of acetylene and air or oxygen
9/4/15	100,408	R.A. Bréviaire	Pneumatic, muzzle-loaded, with muzzle-flash suppressor. Void
24/6/15	125,413	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	Mortar; ammunition described in 14,477/15
24/6/15	125,612	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	Addition to 125,413; ranged by altering size of combustion chamber
2/7/15	16,869	Soc. de Construction des Batignolles (Précédement Ernest Gouin et Cie)	Mortar

Application Date	Patent Number	Inventors	Description
27/7/15	10,882	F.W.S. Stokes	Mortar
30/8/15	12,477	S.F. Stokes	Related to 12,478/15; regulation of gases for range
30/8/15	12,478 cognate 16,179/15	S.F. Stokes	Breech-loaded
21/9/15	13,445	Sir W.G. Armstrong Whitworth & Co., C. Wale, S.M. Murray	Muzzle-loaded stemmed projectiles launched by piston on discharge; relates to mortar and ammunition
22/9/15	13,510	S.C. Davidson	Tripod for constant angle of elevation; bypass vent for propellant gases
11/1/16	100,377	I. Quennehen, R. Moine, J. Fieschi, M. de Mery	Acetylene as propellant; each charge is separately produced
17/1/16	123,656	S.F. Stokes	Range by regulating release of propellant gases
29/1/16	124,489	E. Schneider	Recoil mechanism
2/2/16	103,841	F.F. Mote	Tripod mount
28/2/16	104,525	R.J.W. Dawson	Heated-wire ignition system
16/3/16	104,893	C.T. Crowden	Mounting
1/5/16	124,831	L. Johnstone	Valve for regulating propellant gases in Stokes
19/5/16	16,280	G. Constantinesco, W. Haddon	Hydraulic mortar
17/6/16	125,148	D. Samaia	Trench mortar with noise-reduction system
10/8/16	127,285	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	For firing super-calibre projectiles
21/8/16	125,475	Armstrong Whitworth & Co., Sir W.G. Wale, C. Wale	Combustion chamber for trench mortar
14/11/16	137,873	R. Burn	Tripod for trench mortar
12/12/16	126,324	W. Heap	Mounting
5/1/17	126353	A.L. Chevallier	Mounting
10/3/17	143,275	J.A.M. Goumarre	Tripod for mortar or MG
23/3/17	128,595	G. Constantinesco, J.R. Middleton	Mounting
14/5/17	143,268	G.C. Davidson, C.P. Caulkins	Mounting for light mortar
11/6/17	127,879	J.I. Thornycroft & Co., J.E. Thornycroft, T. Thornycroft	Mounting
27/10/17	129,351	A.J. Stone	Mounting
5/11/17	129,368	S.C. Davidson	Addition to 13,510/15
9/11/17	129,376	J.I. Thornycroft & Co., J.E. Thornycroft, T. Thornycroft	Mounting for light mortar
21/5/18	136,194	R.C. Dodgson	Mounting
20/7/18	127,150	A.S. Adams	Mounting
31/10/18	134,548	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	Automatic loading device for Stokes

Ammunition

Application Date	Patent Number	Inventors	Description
27/7/15	10,883	F.W.S. Stokes	Projectile for mortar described in 10,882
20/8/15	12,036	E. Schneider	Trench mortar projectile
10/9/15	12,985	C. Bingham	Trench bomb with fins
13/10/15	14,477	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	Ammunition for trench mortar described in 125,413
16/11/15	102,594	S.F. Stokes	Trench mortar projectile with propellant cartridge in base; for mortar described in 12,477/15 and 12,478/15
16/11/15	103,270	S.F. Stokes	Use of flat bands of leather, cardboard, vulcanite as gas check on trench mortar ammunition

Application Date	Patent Number	Inventors	Description
29/11/15	16,795 cognate 6,889/15	H. Greener	Ammunition for trench mortar
4/316	104,672	M. Velin, F. Schimmel	Projectiles
6/4/16	104,847	S.R. Parkes	Time fuse for trench mortar ammunition
13/4/16	124,809	F.W.S. Stokes	Trench mortar ammunition fuse
3/5/16	124,836	S.R. Parkes	Cartridge for Stokes ammunition
15/5/16	125,099	O.R. Williams	Ammunition for trench gun
6/7/16	125,411	H. Greener	Time fuse for trench mortar ammunition
10/8/16	127,285	Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc	Super-calibre trench mortar projectile with hollow tail-piece (fits inside barrel) and wings (outside barrel); relates to trench mortar described in 125,612
21/8/16	125,475	Armstrong Whitworth & Co.	Trench mortar ammunition
24/10/17	113,927	H. Wade (Compagnie Général d'Electricité)	Message-carrying projectile
18/1/18	124,473	L.G.P. Thring	Cartridges for trench mortar ammunition

Flamethrowers

Application Date	Patent Number	Inventors	Description
25/1/15	17,794	Schneider et Cie	Remote control vehicle. No patent granted; sealing fee not paid
27/3/15	7,524	J. Hersent, G. Hersent, J.A. Thirion	Gas-pressure operated (also applicable to fire extinguishers!)
18/10/15	14,715	J. Menchen	Valves ensure that gas cannot be turned on until liquid turned on
18/10/15	14,716	J. Menchen	Relates to valves for 14,715/15
29/10/15	15,288	W.A. Hall	Man portable
4/11/15	15,581	J. Hersent, G. Hersent, J.A. Thirion	Apparatus for projecting flaming liquid under gas pressure
13/11/15	16,062	J. Menchen	Specs 14,715/15 and 14,716/15 are referred to
17/12/15	17,696	P.H. Lawrence	Portable combined flamethrower. No patent granted; sealing fee not paid
29/12/15	18,119	A. Kitson	Man portable; relates to ignition. No patent granted; sealing fee not paid
11/5/16	125,097	P.H. Lawrence	Backpack flamethrower. No patent granted; sealing fee not paid
8/3/17	113,973	W.J. Lester	Tank fitted with flamethrower and electrified water projector
10/7/17	128,275	P.H. Lawrence	Man portable; propellant gas bottle inside tank of fuel; igniter cartridge. No patent granted; sealing fee not paid

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Index

accidents 3, 16, 18–19, 22, 68, 77, 82, 95, 100, 158
Addison, Dr 92, 94
Alley & MacLellan 137
all-ways fuse 132
Alsop, Captain 48
alumatol 107
ammonal 99–100
anti-tank grenades 106–7
  No. 44 107
  No. 46 107
Ardee, Lord 93
Armstrong Whitworth 37, 46, 135, 140, 141
Army Council 27, 66, 88, 112, 113, 122, 150
Armstrong, J.A. 76
Asbury, Harry 84
Attwater, Captain 3

Bakelite 83
battles
  Arras 5, 132
  Le Cateau 85
  Loos 7, 16, 24, 25, 151
  Messines 132, 144
  Somme 42, 86, 97, 142, 143, 149, 150, 151–2, 153
  Vimy Ridge 154
  First Ypres 85
  Second Ypres 145, 146, 151
  Third Ypres (Passchendaele) 156
Beard & Fitch 137
Beddoes, Major Claude 67–8, 82
Bessière, Gustave 115
Bickford fuse 11, 12, 15, 132
Billant, L.L. 71, 72
Billinghurst, R.W.B. 91
Bingham, General 93, 94, 128
Black, H.D. 69, 70
Blanch, H.J. 114
Blunden, Edmund 14, 27, 28, 31, 42, 47, 49, 56, 62, 100, 104
bomb-throwers (*see also* grenade-throwers and spring guns) 62
  pneumatic 65
  Temple 122–3
Boss & Co 60
bouncing bomb *see* rebounding bomb
Brett, M.E. 62
Brewerton, Frank 70
Brock 11
Brothers, Lieutenant-Colonel O.F. 7–8, 36, 38, 62, 63, 68, 85, 89, 90, 112, 113
Bryant & May 11
Buckingham, James Frank 75
Burn, Lieutenant, Robert 112
Butler, Major-General Richard 88

Carrington, Charles 84, 85, 86, 87
catapults 11, 65, 160
  copies of Roman 51–2
  French 57, 58–9
  Gamage's *see* Leach
  Glascodine's 60
  improvised 59–60
  Leach 24, 52–6, 58, 60, 61, 66
  Robertson 60–1
  Roman 51
  Wick's Baby 58
Chevallier, A.L. 114
chemical grenades
  No. 28 105–6
  No. 29 105–6
Chapman, Guy 29, 61, 135
Churchill, Winston 128
Colley, Major 93
Compagnie Belge des Munitions Militaires 78
Constantinesco, Gogu 138–9
Cotton Powder Company 7, 97
Crossley, Colonel A.W. 154
cup dischargers (*see also* grenade cups) 80, 88, 89, 90, 95, 105, 106, 112, 158
  Burn 111, 112–13, 115, 121, 160
  Chevallier-Blanch 114
  Thatcher's 112
  Viven-Bessière 114, 115, 121

Daniels, Leslie 91, 93
Dardanelles 12, 24, 53, 54, 65, 128
Dawson, Matthew James 63
Decimals Ltd 22
de Laminne, J. 83
Design Department viii, 92, 93, 94, 128
detonator, No. 8 Mk VII 11, 14, 18
detonator production 5–6, 7
'Development of Weapons used in Trench Warfare' 90
Dewandre, Albert 78, 83
Dover Ltd 82
Dunn, Captain viii, 25, 29, 34, 35

Engineer 69, 70
Evans, Sir Worthington 92
Ewart & Son 18
Explosive Trades Ltd 7

Findlay, C.W. 80
fizzles 48, 134
flamethrowers 69, 142, 144, 145–51, 160
  British
    battery model 147–9
    Hall's 148
    knapsack model 146, 147, 149
    Large Gallery 150
    Lawrence's 149
    Menchen's 146, 147
    Vincent 147, 150
  French
    Hersent 146, 147
  German 140, 145
    Fiedler's 140
'Fortification and Siegecraft' 159
Fraser, Frederick 70
French, Field Marshal 5, 8, 18, 22, 23, 97

Gamages (department store) 52–3
Gardiner, Charles 91, 93
gas warfare (*see also* Livens Projector) 145, 151–6
Gas Warfare Experimental Ground 154
Gauldie, K. and W. 117
Gibbons, A.B. 80
Gibbons, F.J. 84, 85
Glascodine, R,T. 60
Goodwin, Captain H. 154
Gough, Sir Hubert 151
Graham, Stephen 28

Granatfieber 86
Graves, Robert 3, 25–6, 28, 31, 34, 103, 104, 105, 129
grenade cups 109–11
  Hale's 110
  No. 1 Mk 1 80, 110
  No. 4 Mk 1 109, 111
grenade dischargers *see* cup dischargers
grenade guns 118–21
  Lister's 121
  Thring's 119–21
grenade-throwers
  Malloch's 121
  Storch-Davis 122
Griffith, Wyn 42

Haddon Engineering Works 138
Haddon, W. 138
Haig, Field Marshal 85, 88, 144, 151
Hale, Frederick Marten 7
hand grenades
  blinds 82, 94
  carriers 26, 85, 109
  expenditure 23, 24
  failures 24, 89
  fragmentation 14, 17, 21, 22, 24, 74, 89
  patenting 67–9, 93
  production and supply 5, 6, 7, 10, 22, 23, 24, 25, 82, 87, 88, 90, 94
  psychological effect of 86
  throwing 3–5, 12, 14, 16, 84, 85, 86
  training 3, 19, 67–8, 84
  American
    Asbury's 84
  Belgian
    Dewandre's 83
    Roland's 78, 80, 83
  British
    Armstrong's 76
    Ball 16, 24–5, 27, 65, 80, 91, 105
    Battye bomb 15, 16, 18
    Billinghurst's 91
    Black's 69–70
    Box Pattern *see* Hairbrush
    Buckingham's 75–6
    Cricket Ball *see* Ball
    D grenades 66
    DG 91–4
    Double Cylinder *see* Jam-Tin
    egg *see* No. 34
    Hale's *see* No. 2
    Hale's 1911 patented 74
    Hairbrush 10, 12–14, 16
    Humphries 93, 94, 104
    improvised 12, 14–15
    Jam-Tin 10–11, 12, 15, 16, 60, 65, 74
    Leeming's 70–1
    Lemon 16, 17–19, 25, 26, 65, 89
    Marks's 76–7
    Mills (*see also* No. 5, No. 23, No. 36 and rifle grenades) 15, 16, 25, 56, 67, 68, 69, 75, 78–85, 86, 87, 88, 89, 90, 91, 94, 95, 108, 109, 110, 112, 113, 121, 122, 144, 157, 158, 159
    No. 1 2–3, 6, 90
    No. 2 3, 5, 7, 10, 90
    No. 5 15, 27, 79, 82, 84, 85, 155
    No. 6 *see* Lemon
    No. 7 *see* Lemon
    No. 8 *see* Jam-Tin
    No. 9 *see* Jam-Tin
    No. 12 *see* Hairbrush
    No. 13 *see* Pitcher
    No. 14 *see* Pitcher
    No. 15 *see* Ball
    No. 18 6
    No. 19 6, 90
    No. 23 84–5, 112, 114
    No. 34 80, 87–9, 90, 106, 112, 113
    No. 36 85, 112, 159
    No. 69 83
    No. 74 83
    Oval, 16, 25, 106
    Pitcher 16, 19–22, 27, 80, 89, 103
    R grenades 66
    Roodhouse's 74–5
    Senior's 76
    Siegwart's 90
    Still's 72, 74
  French 23
    Besozzi 72
    Billant's 71–2
    bracelet (ball) 15, 16, 17
    Charmier 91, 94
    OF (*offensive-fusante*) 86
    P1 *see* Billant
    Pear 73
    P Modele 1915 71, 73
    petard (Hairbrush) 13, 14, 15
  German 6
    ball (*Kugelgranate*) 1, 8
    Diskusgranate 8, 77
    egg (*Eierhandgranate*) 8, 85
    parachute 24
    stick 8, 9, 27, 85
Harfleur 3, 100
Hartley & Sugden 152
Hay, Captain 146
Heap, Mr 47
Hill, J.A. 64
Hitchcock, Captain 11, 28, 29, 31, 34, 50, 145
Hooge *see* Second Ypres
Hudson, Major 46

igniters 14, 15, 18, 19, 22, 24, 106
infantry
  pre-war engagement ranges vii
  reliance on grenades viii, 85, 119, 157
inventions, number submitted to MID ix
Inventions Branch, Directorate of Artillery 78

Jack, Captain James 7, 27, 29, 146
Jackson, Colonel Louis 8–10, 11, 12, 20, 25, 35, 52, 53, 65, 69, 70, 146, 158, 159
Jarman & Co 18
Jünger, Ernst 40, 48

Kilburn and Strode 120
Kneeshaw, Second Lieutenant Wilfred 117
Kynoch 5

Leach, Claude Pemberton 52–3
Leblanc 86
Leeming, Captain James 69–71
Ley, Captain 93, 94
lighting fuses with cigarettes 11, 14, 78
Lister, F.V. 121
Livens, Captain 142–3, 144, 145, 146, 149–50, 151–6, 158
Livens Projector (*see also* Livens oil can mortar) 33, 145, 151–6, 157, 160
Lloyd George 128, 129, 138

Malloch, P.D. 121
Manchuria vii, 2
Maxwell, Lieutenant-General R.C. 18, 22, 24, 25, 66, 71
Menchen, Joseph 146
MID *see* Munitions Inventions Department
Middleton, J.R. 139
Midland Gun Company, 135
Mills, William 78, 82, 84, 124, 159
  patents 79, 81–2, 102
Mills Munitions Ltd 82

Ministry of Munitions 9, 120, 128, 132, 159
Moir, Sir Ernest 69
Morgan, William 84
Munitions Inventions Department viii, ix, 67, 69, 85, 90, 91, 92, 93, 94, 104, 119–21, 123, 135, 136, 138, 139
Munitions Inventions Panel viii, ix
Murphy, Second Lieutenant 3, 12

napalm 146, 160
Newton 107 fuse 43, 102, 134
Newton, Captain viii, 37, 38, 39, 40, 43, 85, 87, 100, 101, 102, 131, 132, 134–5, 154, 158
New Trench Gun Syndicate 137
Nobel 5, 7
'Notes on Inventions and New Stores' ix, 89, 118, 122

O'Malley, W. 92–3, 94
Ordnance Board viii, 129, 153
Ordnance Committee 129
Ordnance Factories 5, 6, 18
Oritur Manufacturing Co. 80

Parkes, S.R. 80
patents x, 7, 20, 21, 45, 47, 52, 53, 60–5, 67–72, 74–84, 86, 90–3, 102, 103, 111, 112, 114, 115, 117, 119–22, 132–3, 137, 138–9, 141, 144, 146, 147, 148, 149, 161–7
Patents Act 1907, 69

Ransomes & Rapier 124, 126, 127, 129, 136
Reason Manufacturing Company 65
rebounding bombs 50, 123, 125–6
Richards, Frank viii, 34, 78, 85, 103, 130, 157
rifle grenades (*see also* cup dischargers and grenade cups) 89, 90, 94
  carriers 108
  effectiveness of 104
  expenditure 24, 97
  fragmentation 103, 104
  prematures 100, 102, 116
  problems with 95–6, 99
  production and supply 24, 96, 97
  ranging of 104–5
  rods 95, 103, 104, 108
  spotting in flight 102–3
  stands for firing 96, 101, 116–18
    experimental workshop design 118
    Gauldies' 117
    German 116
    Kneeshaw's 117
  British
    DG *see* hand grenades
    Hale *see* No. 3
    Humphries (*see also* hand grenades) 104
    J pattern *see* No. 3
    Mexican pattern 97
    Mills (*see also* hand grenades) 108, 112
    Newton Pippin 43, 100–3, 104
    No. 2 97
    No. 3 96, 97–9, 100, 101, 102, 104
    No. 11 99
    No. 17 104
    No. 20 54, 99, 100, 104
    No. 22 *see* Newton Pippin
    No. 24 100
    No. 25 103
    No. 35 100, 104, 107
    No. 39 104
    Sangster's *see* No. 25
    Stewart pattern *see* No. 39
  German 15
    1913 model 96
    1914 model 96
ring charges 131, 132, 134
Robertson, John 60
Robertson, Sir William 94
Roburite & Ammonal 7, 10, 97
Roland, Captain Leon 78
Roodhouse, Arthur Cardwell 74
Royal Commission on Awards to Inventors 82, 139, 159
Royal Laboratory 2, 6, 17, 104
Rushton Proctor 149
Russo-Japanese War vii, 1

Salsbury, G.C. 80
Sangster, Charles 20, 21, 103
Sassoon, Siegfried 28, 86
Second Army Workshop viii, 37–8, 48, 87, 100, 102, 116, 131, 132, 135
Shaw Grenades 77
Siegwart, H. 90
signal grenades 106
  No. 31 106
  No. 32 106
  No. 38 106
  No. 42 106
  No. 43 106
  No. 45 106
Smith, Captain Godwin 93
smoke grenades
  No. 26 105
  No. 27 105, 106
  No. 37 105
Société de Construction de Batignolles 45
Special Companies, RE 142, 156
spring guns
  Dawson's 63, 64
  Hill's 63, 64
  West Spring Gun 24, 61–3, 65, 66, 105
Starkey, J.W.G. 80
Stewart & Lloyd 153
Still, W.M. & Sons 72
Stokes, Captain Stanley Frederick 136–8
Stokes, Wilfrid 124–9, 136, 141, 159
  patents 132–3
Suicide Club, The 16
Sutton, Captain 128

tear gas 106
Thatcher, G.R., 112
Thring, Leonard 119
Thuillier, General 153
Times History of the War, The 14, 15
Todhunter, Major 37, 38, 53–4, 100–1, 104, 116
Tonite 7, 97, 99
trench mortars
  avoiding shells from 29, 31, 34
  duds 41, 132
  effect on barbed wire 33, 43, 102
  hydraulic 138–9
  misfires 134
  names for 28, 34, 35, 42, 48, 49, 50
  pneumatic 132, 139
  prematures 130–1, 132, 134
  psychological effect of 28–31, 33, 40
  schools 46, 47, 48
  use of nineteenth-century mortars 35, 36
  British
    2 in 39–43, 45, 132, 134, 139, 159
    3.7 in 38–9, 45, 130, 134
    4 in 39, 45
      smooth-bored 38
      rifled 35–36, 38, 134
    6 in *see* Stokes-Newton
    9.2 in 140
    9.45 in 28, 45–8, 134, 140, 141
    10 in 141
    11 in 140
    BEF Trench Howitzer 135

Captain Stokes's 136–8
Constantinesco's 138–9
dangers of 34, 40
flying pig *see* 9.45 in
improvised 35, 54
Livens oil can mortar (*see also* Livens Projector) 135, 142–4
manufacturing problems 36–7, 47
Stokes 34, 35, 40, 43, 66, 69, 120, 124–33, 134, 157, 158, 159
Stokes-Newton 43, 45, 48, 132, 134–5, 140, 158
toffee-apple *see* 2 in
French 35, 49
58 mm 44, 45
80 mm 49
aerial torpedoes 44
Brandt pneumatic 132, 140
Claude 135
Schneider's mortar shell 141
Soc. Anon pour l'Exploitation des Procédés Westinghouse-Leblanc 141
Taupia 36
German 30–4
75 mm 29, 34, 41
destructiveness of 33–4
Flügelminenwerfer 30–1, 32, 33
Granatenwerfer 48–9, 50
Lanz 41
medium 28, 29, 33–4
pneumatic 139
Priest *see Granatenwerfer*
Trench warfare
development of new weapons for viii
start of 2
Trench Warfare & Armaments Ltd 91
Trench Warfare Committee viii, 37, 46, 47, 48, 91, 93, 154
Trench Warfare Department viii, 6, 7, 15, 37, 56, 58, 67, 69, 70, 82, 85, 87, 89, 90, 91, 92, 97, 104, 106, 129, 132, 154
Trench Warfare Supply Department viii, 58, 65, 69, 70, 144, 153
Vaughan, Lieutenant Edwin Campion 49
Vickers 35, 37, 135, 140, 147
Vickery 82, 84, 85
Vickery's Patents Ltd 82
Vincent, Captain 146, 147
Viven, Jean 115

waistcoats 26
Walker, J. 80
War the Infantry Knew, The 12
West, Captain 61, 65, 128
West & Co, A. 65
white phosphorus 105
Wicks, Captain 58
William Mills Ltd 82
wire-cutting 43, 102, 134
Wood, A. and G. 65
Wooderson, Sergeant 46
Woolwich Arsenal viii, 17, 35, 38, 39, 91, 97

Zeebrugge raid 150, 151

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